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OF THE SALIVA COMMONLY FOUND IN THE FLOOR
OF THE MOUTH

SCHOOL OF AVIATION MEDICINE
RANDOLPH AIR FORCE BASE, TEXAS

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THE SODIUM AND POTASSIUM CONCENTRATIONS OF THE SALIVA
COMMONLY FOUND IN THE FLOOR OF THE MOUTH

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In the past, investigators have referred to the collection of "resting" or "nonstimulated" saliva samples. While exogenous stimulants have been omitted in such studies, psychic stimuli have, in all instances of which we are aware, been present. A strong psychic stimulus is automatically created by suggestion when a subject is presented with a collection tube and is instructed in the collection procedure. From these previous studies then, it could not be said that the fluid being collected was that which normally bathed the oral structures during most of the waking hours. It was, rather, this fluid plus an additional secretion resulting from some degree of psychic stimulation and possibly from mechanical stimulation. Oral movements account in many instances for the mechanical type of elicitation.

This paper is intended to (1) describe a method for the collection of small amounts of nonstimulated saliva; (2) provide a method for the analysis of these small specimens and an evaluation of the reproducibility and reliability of the method; and (3) present means, standard deviations, and correlation coefficients for an experiment based on these procedures.

PROCEDURE

Collection method

Of principal concern was the obviation of the psychic stimulus of any knowledge on the part of the subject that saliva was to be collected. For this reason, the subjects were grouped in a large room and allowed to enter into the collection room singly and were allowed no later contact with the nonsampled group. As the subject entered the sampling room, a graduated centrifuge tube was placed in his right hand, his hand was directed upward

toward the mouth and he was told to spit all of the saliva in his mouth into the tube. An accurate time check was kept and only 2 seconds were allowed for the subject to expectorate into the tube. Pursing of the lips or any other such movement immediately disqualified the subject. A careful check was made to see that no exogenous stimulants such as food, drink, or chewing gum had been employed for at least one hour prior to collection.

The subjects participating in this experiment were male airmen who were undergoing routine indoctrination in the United States Air Force. They were thus conditioned in that they had been trained to execute commands without hesitation. The subjects are customarily grouped together for their entire training period. Occasionally, some are separated from the group for personal reasons or for military purposes (e.g., interviews), but the group maintains continuity in essentially all activities. It was during one of these normal instructional periods that the airmen were brought to a familiar area and one subject at a time was allowed to enter the sampling room.

All collections were made between the hours of 0800 and 1000. All subjects were between the ages of 17 and 22 years and each had been recently judged physically qualified for service in the Air Force. Breakfast menus had been identical within the groups sampled on each day. It was not at all unusual for the subject to misunderstand the directions and make no effort to expectorate during the 2-second period. Many participants produced a volume of less than the 0.15 ml. that had been set as a minimum. Thus, of a total of 1,250 subjects that were exposed to this procedure, only 456 samples were available for analysis.

Analytic methods

One-tenth ml. of the fresh saliva specimen was pipetted into 0.5 ml. of 4 percent trichloroacetic acid and the pipette rinsed three times in the precipitant. This mixture was thoroughly shaken, allowed to stand for at least 10 minutes, and 1.4 ml. of ion-exchange water was added (final dilution, 1:20). After centrifugation (3,000 r.p.m. for 5 minutes) the supernate was aspirated into the hydrogen-oxygen flame of a Beckman DU flame spectrophotometer equipped with spectral energy recording adapter and photomultiplier. Serving as working standards were dilutions of a stock standard that contained the following: sodium, 25.0 mEq./liter; potassium, 25.0 mEq./liter; calcium, 5.0 mEq./liter; magnesium, 1.5 mEq./liter; phosphorus, 10.0 mEq./liter; and trichloroacetic acid, 1 percent. This method was tested for reproducibility and recovery with the following results: sodium—coefficient of variation 2.3 percent

and mean recovery 98.0 percent; potassium—coefficient of variation 1.9 percent and mean recovery 98.2 percent.

Means and standard deviations were calculated for volume, Na, K, and Na/K. Volume levels and the means associated with these levels for each of the other three variables were also determined. Correlation coefficients were computed to indicate the relationships of volume and sodium, volume and potassium, and volume and Na/K.

RESULTS AND DISCUSSION

For the 456 subjects, the volume mean was found to be 0.31 ml. (S.D., 0.15), the sodium mean was 8.79 mEq./liter (S.D., 3.62), the potassium mean was 25.66 mEq./liter (S.D., 9.31), and the Na/K mean was found to be .374 (S.D., .201) (table I). The sodium data agree very well with that of a previous study from this laboratory (1) in which whole saliva was collected without exogenous stimulation. In this earlier work, the sodium mean was 9.70 mEq./liter (S.D., 3.68). When the comparison is extended to the potassium data, it is noted that, in the earlier investigation, the potassium mean was only 21.51, some 4.0 mEq./liter less than the present study. The outstanding finding, however, is the 9.31 mEq./liter standard deviation of the distribution for potassium in the present study, which is three times the finding of 3.13 for the previous study. In past work we have reported standard deviations for potassium distributions of 1.21 for 112 subjects (2); 1.06 for 65 subjects (2); 1.68 for 59 subjects (2); 3.48 for 402 subjects (3); 3.13 for 516 subjects (1); and 2.93 for 540 subjects (4). It appears that potassium is a relatively more stable constituent in stimulated saliva than in the nonstimulated saliva commonly found in the floor of the mouth. This variability could be due to many things, among them bacterial type and population, epithelial sloughing, etc. Since the variability is so great between subjects, however, it is interesting to speculate that possibly more definitive factors might be involved.

The means associated with ranked volume observations are shown in table I. Frequency distributions for sodium and potassium are outlined in figures 1 and 2, respectively. The

TABLE I

Means associated with ranked volume observations

Volume interval (ml.)	Means			Number of subjects
	Na*	K*	Na/K	
0.15	9.12	27.21	.349	64
0.20	9.20	25.49	.389	94
0.25	8.47	24.88	.370	64
0.30	8.37	25.06	.371	83
0.35	8.63	24.99	.365	29
0.40	8.44	24.36	.406	42
0.45	10.04	28.26	.425	11
0.50	9.35	26.93	.373	24
0.55	9.14	22.40	.423	9
0.60	8.57	26.62	.368	16
0.65	7.92	27.48	.310	6
0.70	8.50	30.49	.276	4
0.75	8.85	26.16	.396	4
0.80	6.73	27.00	.235	3
0.85	7.60	28.70	.265	1
1.10	9.40	28.50	.380	2
Grand means	0.31	8.79	25.66	.374
S. D.	0.15	3.62	9.31	.201

*Millicquivalents per liter.

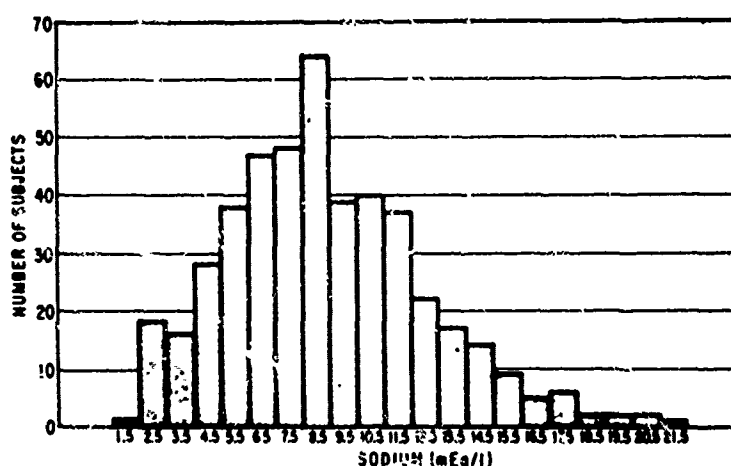


FIGURE 1

Frequency distribution for sodium concentrations.

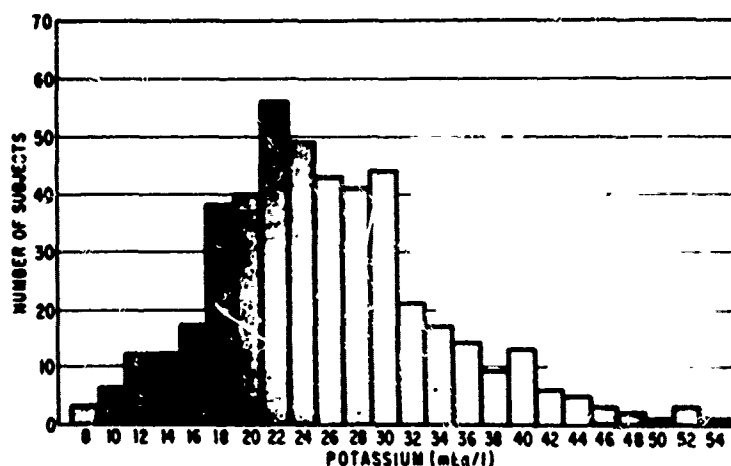


FIGURE 2

Frequency distribution for potassium concentrations.

correlation coefficient for volume and sodium was $-.03$, while that for volume and potassium was $.02$, and that for volume and Na/K was $-.008$. None of these coefficients were significant. That is to say, the larger volume samples were not consistently higher or lower in concentration for any of the variables studied.

SUMMARY

1. A method is presented for the micro-determination of sodium and potassium in human whole saliva.

2. A procedure is suggested that obviates the psychic stimuli associated with saliva collection.

3. A total of 456 subjects was studied by the method described above, and the data resulting from this experiment are described by means, standard deviations, and correlation coefficients.

4. Means of 0.31 ml., 8.79 mEq./liter and 25.66 mEq./liter were found for volume, sodium, and potassium, respectively. An exceptionally large standard deviation (9.31 mEq./liter) was noted in the potassium distribution.

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